

Report for 2002TN4B: Water Supply Options for Cumberland County, Tennessee: A Policy Assessment

- Other Publications:

- Feldman David L, Aaron S Routhe, Emily N Heinrich, Tennessee is a Water Rich State: Myths and Realities, at the 2nd Tennessee Watershed Roundtable, Nashville, TN, March 27, 2003.
- Feldman David L, Water problems in the Southeast: what we know and what we can do about them, Business Opportunities 2003: East Tennessee Environmental Business Association conference, Alcoa, TN, November 6, 2002.
- Feldman David L, The State of Affairs: Challenges Facing Southeast and Gulf States in the 21st Century, When the Water Runs Dry; Maintaining A Balance Between Human Water Use and Environmental Needs, Gulf Restoration Project Conference, New Orleans, Louisiana (sponsored by Mott and Turner Foundations and EPA Gulf of Mexico Program), September 9, 2002.
- Heinrich Emily S, Robert Freeland, David L Feldman, Using ArcIMS to Support Water Supply Policy Development, Southeast Regional Users Group meeting, Chattanooga, TN, November 6, 2002.
- Heinrich E S, Robert Freeland, David L Feldman, Social, Economic, and Legal Implications in Selecting Water Supply Options, 9th International Symposium on Society and Natural Resource Management, Indiana University, Bloomington, IN: June 2-6, 2002.
- Routhe A S, Emily Heinrich, Reaching Accord on Meeting Water Supply Needs: Citizen and Decision- maker Perspectives, Georgia Water Resources Conference, Athens, GA, April 24, 2003.
- Routhe A S, Robert Emmet Jones, Reid Morrow, Conflict and Collaboration in Regional Water Supply Management, 9th International Symposium on Society and Natural Resource Management, Indiana University, Bloomington, IN: June 2-6, 2002.
- Two presentations and a poster were presented at the 13th annual Tennessee Water Resources Association meeting at Montgomery Bell State Park, April 9-10, 2003. The poster was: The Southeast Water Policy Initiative, by D. Feldman, R. Freeland, C. Harden, R. Jones, F. Walker, A. Routhe and E. Heinrich. The papers were: Heinrich, E., Using Geographic Information Systems to Support Water Supply Policy Development, and A. Routhe, Resolving Water Disputes: Citizen and Decision-maker Perspectives.

Report Follows:

The world is facing a freshwater crisis. People already use over half the world's accessible freshwater, and may use nearly three-quarters by 2025. Over 1.5 billion people lack ready access to drinking water and, if current consumption patterns continue, at least 3.5 billion – nearly half the world's projected population – will live in water-stressed river basins in just 20 years (UNWWAP, 2003). This problem of unsustainable water use is global: economic growth everywhere is constrained by water supply and quality.

Water supply is not just an issue in developing nations. Spain, for example, is pushing for a Hydrologic Plan that will involve the creation of many additional dams and reservoirs. The Yellow River in China, Colorado River in North America, and the Murray River in Australia are among the Earth's major rivers that are regularly depleted of their waters (UNWWAP, 2003). Even in the seemingly water-abundant U.S., increasing municipal and industrial demands for water have led to conflicts over water rights and are constraining growth. Agriculture alone accounts for 70% of water usage - mainly for crop irrigation. As the world's population grows, irrigated land is expected to become increasingly significant in feeding people. While the problem is global it manifests itself locally thus, and is thus becoming a local government concern.

Local governments are more prominent than ever in water resource decisions that provide economic opportunities locally, as well as those issues perceived as threatening to water quantity and quality such as: sharing supply with neighboring regions, impacts to stream biodiversity, and threats to water quality by way of terrorist attack. It is not uncommon for local officials to address water resource issues, such as procuring residential and commercial water supplies, alleviating water quality concerns, mitigating impacts on wetlands, or diverting water between watersheds (Berry et. al., 1996).

This study focused on Cumberland County, a Tennessee county located atop the Cumberland Plateau that forms the western section of the southern Appalachian Mountains. According to the 2000 Census, Cumberland County is the sixth fastest growing county in the state, up 35% since 1990. The county's limited water resources are increasingly stressed by competing user demands stemming from the escalating population, attendant economic development, and increased urbanization. Adding to the problem, the average elevation of the area is 1200 meters above sea level and the average annual precipitation is 145 mm. The precipitation and its temporal and spatial non-uniform distribution, coupled with elevation and depth to groundwater sources have a magnified effect on the water resources in the region.

Concerns about water shortages are not new to the county. The Cumberland County Regional Water Authority (CWRA) was formed in 1999 by an act of the state legislature and subsequent approval by the Cumberland County Commission (Young, 1999). The purpose of CWRA is to encourage regional water supply planning by examining the potential for cooperation among utility districts to provide for future water supply needs. The Tennessee Department of Environment and Conservation (TDEC) has hoped that CWRA would serve as a model for "regionalization" of water planning (TDEC, 1998). While the five rural utility districts quickly signed on to be part of CWRA, to date the City of Crossville, the county seat and supplier of 80% of the county's water, has chosen not to participate. Crossville's refusal to join CWRA has been attributed to the fact that each member district is allowed a single vote, and the city feels it would be at the mercy of the county districts, which collectively have five votes (Young, 2000a).

Several studies have been commissioned to identify future sources of water for the region – but until our study was undertaken – no study sought to determine decision-maker concerns. Since 1988, utility districts within the county have been actively pursuing a new water supply source. This pursuit became more intense in 1992 when a proposed dam on Clear Creek was rejected by state and federal regulatory agencies. In 1998, the Army Corp of Engineers completed a preliminary engineering report outlining several possible alternatives for meeting the county's future water supply needs. In addition to outlining several possible options, it provided information regarding the economic, environmental, and engineering feasibility of each one (ACE, 1998). However, the study did not make any recommendations. It was designed to be merely a tool for planning. Despite the engineering and technical feasibility of all of the options mentioned in the Corps report, no action has been taken toward

implementation. The City of Crossville has also independently studied potential water sources. It determined that the construction of an impoundment on the Caney Fork River was the best strategy and official began a formal study and the permitting process in the fall of 2000 (Young 2000b).

(7) Methodology and Accomplishments to Date:

In order to assist Cumberland County's decision makers in alleviating their water needs, this project employed a two-fold approach: GIS development; and decision-maker interviews.

GIS Development: GIS is an information technology increasing used in public policymaking, particularly for environmental planning and management because it provides access to timely, accurate information that is fundamental to sound decision-making. GIS can successfully help to: identify and guide needed government action on water supply planning and management; enhance the accuracy and efficiency of governmental operations; increase the transparency of government decision-making; and help build regional and national networks. It also helps overcome lack of skills in advocacy by allowing scientist to depict information in a manner that allows decision makers to make up their own minds.

In this portion of the study, our objective was to examine decision-making and GIS applications in Cumberland County, Tennessee in order to help better design a tool for storing, analyzing, manipulating, retrieving, and displaying attributes of spatial data representing multiple databases, formats, and sources for dissemination to resource managers, planners, decision makers, and the public.

To meet our research objective the Cumberland County Water Resources Atlas (CCWRA) was created using Environmental Systems Research Institute's (ESRI) ArcIMS technology. ArcIMS provides the foundation for distributing high-end GIS and mapping services via the Internet. ArcIMS software allows users to integrate local data sources with Internet data sources for display, query, and analysis in an easy to use Web browser. Because it was specifically built to serve GIS on the Internet, ArcIMS is designed to make it easy to create map services, develop Web pages for communicating with the map service, and administer sites. Using this technology allows users of the CCWRA to browse and interact with maps and data using their standard Web browser without requiring the purchase of expensive GIS software.

Decision-maker Interviews: The design goals of the atlas were to disseminate information pertinent to Cumberland County's water supply. To determine the types of information needed, informal interviews were held with six different decision makers in Cumberland County prior to designing the atlas. The interviewee's represented four types of decision makers from the area: state and federal agency representatives, local elected officials, utility district board members or managers, and representatives from environmental and conservation organizations.

Each participant was informed about the production of the atlas and its goal as a tool for use by anyone interested in the water supply issue. The participants were asked: "In order to make this GIS tool useful to yourself (or your organization) as well as the citizens of Cumberland County, what types of information would you (or your organization) like to see depicted and how do you feel this information will be helpful?" Five of the six decision makers responded with various suggestions on what they thought would be useful (**Table 1**). One of the six decision makers stated that they "did not see a need for computer assistance with their water supply issues".

Table 1. Decision Maker response to preliminary question regarding what types of information they would like to see in the atlas.

Participant #	Affiliation	Suggestion
1	Environmental	What/ Who will be impacted by each water supply option
2	Utility District	Where water lines are
3	Utility District	Tool will not be useful to citizens without Internet capabilities
4	Local Government	Supply each option is capable of providing
5	Local Government	Which options are capable of meeting long term demands
6	State and Federal	Information on Utility district operations

Interviews were used to examine the perspective of decision makers on the county's water supply problems. Decision makers hold contradictory notions on which, if any, option should be chosen for meeting future water supply needs (Rich, 1997). We contended that before any option is implemented, accord must be reached by making sure to take into account the needs and demands of the county citizens and decision makers. To determine public acceptability face-to-face interviews were conducted in the county's various communities and with stakeholders from four groups: (1) utility district board members and managers, (2) city and county officials, (3) state and federal agency officials, and (4) representatives of environmental, conservation, and recreation organizations from in, and around, the region. The purpose of the interviews was to determine public support of efforts to regionalize the utility districts and preference of supply options.

Interviews were scheduled and performed at the interviewee's home and office. Interview questions were designed to be non-threatening and unbiased. To date 57 interviews have been completed and analyzed. When completed we will have 60-70 interviews. Based on a content analysis of local media interview participants were selected and classified into four groups. In order to ensure interviewee's agreed with that classification they were also asked to classify themselves at the beginning of every interview. Only once did our classification conflict with the group with which participant associated.

(8) Principal Findings and Significance:

Many are viewing the atlas. By monitoring the Website established for our research program (the Southeast Water Policy Initiative), we have been able to determine the types of users accessing the atlas and what country they are accessing it from. While privacy considerations prevent us from determining exactly who is using the atlas and to what end, general statistics are encouraging. In April 2003, the CCWRA Website received over 170,000 requests domestically. The greatest number of "hits" came from educational servers (nearly 70,000). Nevertheless, the atlas also received numerous requests from commercial, network, and government servers between 35,000 – 50,000 hits). Similarly, people from other countries are viewing the atlas. In just one month, we received requests from more than 50 countries.

It is impossible to determine whether every decision maker involved in the Cumberland County issue finds the atlas useful. However, in verbal comments with various decision makers we have received positive feedback ranging from "wow this is neat" to statements of the benefits such a tool provides. One representative of a state and federal agency stated that the atlas was extremely useful to his organization and likewise could greatly benefit the government officials of Cumberland County. Within the region, the CCWRA appears to be a tool for disseminating important data regarding water supply by geographically depicting complex relationships. The audience for the atlas includes water users, planners, and decision makers. Within the atlas, the public will have access to spatial information such as the distance from their homes to a proposed water storage location, discharge pipe, or abandoned mine. Planners can relate current and proposed hydrologic features and structures to important variables such as land use, urban areas, and population growth. Decision makers can compare proposed water sources to permits for water quality and determine what types of pollutants are discharged upstream.

In regards to decision-maker attitudes, a number of significant findings have emerged in three areas. These are: 1) perceptions of future water supply problems; 2) the sufficiency of a single option for meeting water supply needs; and 3) policy-maker preference for various options for actually meeting water supply needs. Major findings under these three categories are as follows:

1. Of a total of 48 decision-makers interviewed in spring 2003, 66% believe water supply problems are very likely within 10 years, while 82% believe they are very likely in 50 years.
2. 23% of decision-makers believe water supply problems are very unlikely to occur within 10 years, while 9% believe they are highly unlikely to occur in the next 50 years.

3. As regards the sufficiency of a single water supply option, 86% of decision-makers interviews believe no single option can meet the country's water supply needs, while 14% believe a single option can satisfy the country's needs.
4. 45% of decision-makers interviewed favor building a new dam; while 31% favor raising the height of an existing dam to provide adequate supply. 12% believe groundwater can be utilized, 10% favor greater conservation, and 2% favor water harvesting.
5. The project has also provided the research base for the direct training of one graduate assistant in Biosystems engineering, as well as the indirect training of a second student in sociology who assisted with the project.

(9) Future Research and Funding:

The future of the atlas is expected to be comprehensive. As new data is collected, additional elements will be incorporated, such as results of a survey of the public and further interviews with decision makers. The atlas may assist in water policy formulation in Cumberland County by referencing social and environmental data to spatial or geographic coordinates on one platform for use by resource managers, planners, and decision makers over the Internet. CCWRA is can be easily accessible to a variety of non-technical users, as well as be modifiable in response to decision maker needs. The atlas will facilitate a better understanding of the connection between social and natural resource constraints on water supply among decision makers in Cumberland County – by providing images that illustrate the various issues. The atlas could serve as a template, adaptable by other areas facing similar problems: where users would input there own data enabling the atlas to spatially depict important issues pertaining to their unique problems

Initial interviews with decision makers reveal a wide variation of views about possible options for meeting future needs – dependent, of course, on future funding as well. Based on this, we are continuing to testing four hypotheses in the formal interviews. The first is that utility districts and local officials will be most likely to support structural options. Second, environmental, conservation, and whitewater recreation groups will be less likely to support any structural option. These groups, however, will support any option that promotes conservation, limits growth, or encourages regional cooperation. Third, state and federal agencies will support any option that has consensus. Finally, contention between the county and city for control over water supply options will block accord. While some citizens embrace the alternative paradigm, most decision makers continue adhering to the traditional dominant paradigm for managing water resources.